

Craigslist Reduced Violence Against Women*

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Abstract

Black market participants face considerable risks when providing illegal services, but sex workers are perhaps the most vulnerable due to serious threats of deadly violence. Investigative journalism and anecdotal evidence have reported that sex workers perceived significant safety benefits from advertising and screening customers using Craigslist’s “erotic services” (ERS) section, which was used almost exclusively by sex workers offering illegal sex services. Protected by the Communications Decency Act, Craigslist expanded ERS from 2002 to 2010, ultimately providing the service in every market that Craigslist served. Using the geographically-staggered rollout of ERS, we estimate that ERS reduced the female homicide rate by 10-17 percent, with the reduction driven by street prostitution moving indoors and by helping sex workers to screen out the most dangerous clients. These results suggest that there may be adverse safety consequences that result from the 2018 passage of the “Fight Online Sex Trafficking Act” (FOSTA), which led to the closure of almost all websites that US sex workers had previously used for online solicitation and safety screening.

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1 Introduction

Prior to the Internet, illegal sex work was a dangerous occupation with a high homicide rate. While the exact number of sex workers in the United States is difficult to establish, a common claim made is that the number of yearly full-time female sex workers is 23 per 100,000 (Potterat et al., 1990). Potterat et al. (2004) estimate that the workplace homicide rate for female sex workers is 204 per 100,000 person-years.¹ Outdoor solicitation (i.e., street prostitution) has historically been considered the most dangerous market segment for sex services with a death by homicide rate over 13 times higher than the general population (Lowman and Fraser, 1995; Church et al., 2001; Potterat et al., 2004).²

A seemingly benign 1996 telecommunications bill called the Communications Decency Act (CDA), coupled with the emergence of the Internet, set into motion a series of events that profoundly altered illicit sex services markets (Leary, 2018). The Internet reshaped sex markets by allowing the creation of a myriad of institutions and technology-mediated practices that facilitated matching and reduced search costs (Cunningham and Kendall, 2011*a*, 2016). In the United States, these practices were enabled by platforms that were protected by the CDA against liability for content posted by users. Of particular importance was the emergence of centralized online clearinghouses for classified advertising (e.g., Craigslist, Backpage) and searchable review databases (e.g., The Erotic Review). Because these CDA-protected platforms allowed for the easy exchange of information and the coordination of sex work transactions, they spurred considerable debate and controversy. Some observers claimed these changes made the underground market safer (Bass, 2015*a,b*) while others argued the opposite (Hughes, 2004). Until this study, no evidence about its causal effects has been available.

In general, labor market clearinghouses improve markets through market thickening, reduced search and screening costs, and safer market participation (Roth, 2008). As-

¹By comparison, the second most dangerous occupation for females is the liquor store employee which has a workplace homicide rate of 4 per 100,000 (Castillo and Jenkins, 1994).

²This high level of mortality risk may have been somewhat more palatable because economic mechanisms evolved to manage that risk. These include compensating wage differentials (Rao et al., 2003; Gertler, Shah and Bertozzi, 2005; DeAngelo et al., 2017), sorting indoors (Church et al., 2001), and/or integrating with intermediaries such as agencies, brothels and pimps (Reynolds, 1986; Levitt and Venkatesh, 2007) who provide screening and protection to sex workers in exchange for a percentage of revenue.

suming that sex markets react in a similar manner to legal markets, and because sex markets are characterized by a high level of violence, a thickening of the market would be expected to increase potential violence (Schapiro and Alpert, 2011). However, this might not be the case if the market thickening is accompanied by additional structural reorganization. In the context of prostitution, online clearinghouses have the potential to improve safety by redirecting exchange through the clearinghouse and replacing more risky outdoor face-to-face transactions and/or other intermediaries (e.g., pimps) with indoor, direct transactions (Bass, 2015a,b). Matching online through the clearinghouse enables both sides of the market to discern the quality of the match *ex ante*, through such activities as informal screening, circulated black and white lists, and online reviews (Cunningham and Kendall, 2011b; Grant, 2009).³ This may provide the ability for sex workers to identify and screen out violent clients, law enforcement, and scammers. We seek to better understand this complex phenomenon by investigating the research question: *What were the impacts of online clearinghouses on female safety through the reshaping of illegal prostitution markets?*

In this study, we investigate the impact of the introduction of an online clearinghouse on female safety using the staggered roll out of Craigslist around the US for identification. From 2002 to 2010, Craigslist provided a service on its front page for matching buyers and sellers of *erotic services* (ERS). ERS originally provided free advertising to legal sex workers such as private dancers, but was quickly captured by illegal sex workers openly soliciting clients. ERS did not exist when Craigslist was initially launched. Rather, ERS was added later at different times in different cities as one of a bundle of 14 unrelated “services” sections of the website (e.g., legal, events, lessons, financial, real estate). We use the updating of the Craigslist front page with an ERS section in different cities at different points in time to identify the causal effect of ERS on violence against females.

We provide evidence that the introduction of the Craigslist ERS thickened the internet-mediated market — reviews at *The Erotic Review* increased by 43 percent after the introduction of ERS. Further, rather than simply increasing the size of the online market,

³Examples of informal screening include calling a client at his workplace, conducting extensive background checks online, and requiring letters of reference (Cunningham and DeAngelo, 2017).

the introduction of ERS caused additional structural changes, evidenced by the increase in the use of Craigslist emails, and the shift in the composition of the online market from predominantly agency-based transactions to sex workers working independently. Most importantly, we find evidence that ERS significantly reduced female homicide rates by as much as 10-17 percent. We do not find evidence that this was a more general reduction in homicide, as ERS is unrelated to male murder, females killed by an intimate partner, or manslaughters. This strengthens our assessment that ERS-driven changes in sex markets were the primary driver of the reduction in female murders.

While we cannot be sure that the opening of ERS is conditionally exogenous to the unobserved determinants of violence against women, we do know that its opening was unannounced and unexpected as Craigslist does no advertising before entering markets or making changes to its website. ERS was introduced only when Craigslist chose to roll out a new bundle of 13 other services, none of which related to sex work, as opposed to ERS alone. Third, we examine the pretreatment leads between treatment and control cities and show that both sets of cities had been traveling the same time path prior to treatment, on average, with regards to female homicides. Fourth, we examine the effect of ERS on a range of plausible falsification violent crime outcomes associated with more general secular violence trends, but not obviously related to ERS: female intimate partner homicide, male homicide and manslaughter. We find no effect on any of these placebo outcomes.

We propose three mechanisms that could explain our results. First, ERS may have enabled more screening, such as the use of references or background checks when seeing new clients. Second, the growth of the market, combined with more efficient matching may lead to repeat business with low-risk clients, thereby making the market lower risk to sellers. Third, the introduction of ERS may have caused outdoor street-based prostitution to transition to the safer, indoor channel. If so, then we would expect the composition of online sex workers to shift towards the marginal sex worker who would more likely be a former street sex worker. Our results indicate that the decline in female murders can be at least partially explained by more efficient matching, growth in repeat business, and the transition of outdoor sex workers to indoor venues.

The remainder of this article is organized as follows. In sections two and three, we discuss CDA, Craigslist’s ERS, opposition to the introduction and presence of ERS, as well as our theoretical basis for causal effects. In section four, we describe the four unique data sets used in this study. In section five, we present evidence on the influence of ERS on providers reviewed at The Erotic Review. In section six, we present evidence of the mechanism that links ERS to reductions in female homicides. In section seven, we report a series of robustness analysis supporting our claim that ERS reduced female homicides. In section eight, we explore the mechanisms that caused the decline in female violence. Finally, in section nine, we conclude and discuss the implications of our study for market participants and law enforcement in the sex services space.

2 CDA, Craigslist, and Associated Opposition

2.1 1996 Communications Decency Act §230

In 1996, Congress significantly altered telecommunication law by deregulating the broadcasting market through amendments to the Communications Act of 1934. While Congress’s stated goal was to create more competitive markets in the telecommunications arena, the bill was far more sweeping due to its regulation of Internet speech. The original language of the Act contained anti-indecency and anti-obscenity provisions, while also providing criminal liability for a person who knowingly used a website to send to a legal minor comments, requests, suggestions, proposals, images or any other type of communication that depicted or described sexual or excretory activities (Kuzma, 2013). The bill became known as the Communications Decency Act because of these anti-obscenity provisions.

These anti-obscenity provisions were challenged on 1st Amendment grounds and the Supreme Court struck down the criminal liability provisions in the 1997 case *Reno v. ACLU*. The Court concluded that while it has “repeatedly recognized the governmental interest in protecting children from harmful materials”, the anti-obscenity provisions of CDA posed an unacceptable burden on adult speech. The Court noted that “the CDA lacks the precision that the 1st Amendment requires when a statute regulates the content of speech” (Kuzma, 2013).

With the Supreme Court gutting the anti-obscenity provisions, a separate provision found at §230 entitled “Protection for private blocking and screening of offensive material” shaped the CDA’s subsequent influence on the Internet’s evolution. Part (c) of §230, entitled “Protection for ‘Good Samaritan’ blocking and screening of offensive material”, had two relevant subsections for our discussion. The first stated that “No provider or user of an interactive computer service shall be treated as the publisher or speaker of any information provided by another information content provider.” The second point referenced civil liability and stated that “No provider or user of an interactive computer service shall be held liable on account of” the publishing on the website by third parties.

The consequences of §230 were far reaching because they provided nearly complete immunity for websites that published content by third parties (Kuzma, 2013). Since the section clarified that the website itself was neither the publisher nor the speaker with respect to information posted by others on the site, it therefore could not be held liable as an editor of the content of third party specific postings under libel laws or other torts that may be committed by those who post on the site. Through repeated decisions, courts have found nearly complete civil immunity for websites due to CDA §230. It was a profoundly important legal precedent because it resolved considerable uncertainty regarding liabilities which laid the foundation for the Internet’s explosive growth.

2.2 Craigslist and ERS

The classified advertising platform Craigslist (<http://www.craigslist.org>) is one of the most commonly visited websites in the world.⁴ Craigslist is a generic classified-advertising website that facilitates multiple unrelated matching markets on a single, consolidated platform. Matching market interactions that take place on the Craigslist platform include job and resume posting, real estate/rental markets, general goods and services transactions, and dating/personal ads. Craigslist was founded in 1995 in San Francisco, began expansion in 2000, and then accelerated expansion across the US between 2004-2010 (Wolf, 2009). Craigslist’s expansion focused initially on large cities, but by 2010 covered most

⁴Alexa, a commercial web traffic data company owned by Amazon (<http://www.alexa.com/siteinfo/craigslist.org>), ranks Craigslist the 15th most popular website in the United States.

US cities and, as of 2017, the platform had a presence in over 700 locations, including multiple markets outside of the US.⁵

After the initial launch, Craigslist repeatedly updated its site, each time without any advertising or announcement forecasting users about the imminent changes. Most of these updates took the form of subtle changes to its front page, including the augmentation of the services section. This section was expanded over time to include fourteen services, one of which was ERS. ERS was simply an advertising channel for legal erotic services such as private dancing, and almost immediately it was captured by illicit sex workers who used it to openly advertise to clients. Craigslist provided this service, despite its notoriety, in part because they were protected by its legal shield, §230 of the CDA.⁶

Figure 1 provides an example of the Craigslist front page before ERS while Figure 2 shows the front page of Craigslist after the introduction of ERS. Note that the updating of the front page included several additional services in addition to ERS. Further, Craigslist phased ERS into its front page in different markets over time, as illustrated in Figures 3-5. The introduction of ERS followed a heterogenous path, hitting the West Coast first, selecting larger cities next, and then moving away from the west coast gradually.

The impact of Craigslist on markets, both online and offline, was significant.⁷ With regard to public health, Craigslist’s entry has been associated with increased HIV incidence rates (Chan and Ghose, 2014; Greenwood and Agarwal, 2016), and an increase in online prostitution trends (Chan, Mojumder and Ghose, 2018).⁸ But the effects of ERS have not been as extensively studied; what little we do know suggests that different effects

⁵Dates and locations of Craigslist expansion are listed here: <http://www.craigslist.org/about/expansion>.

⁶Craigslist eventually introduced pricing of ads at ERS at the recommendation of law enforcement who hoped that it would deter activity. While ads did decline under this price increase, Craigslist’s revenues from the section increased substantially – potentially by tens of millions of dollars. See Cunningham and Kendall (2010) for a discussion of the impact that the introduction of pricing had on ERS advertising.

⁷For example, Craigslist’s market entry was associated with reduced classified advertising rates, increased subscription prices, and reduced circulation for print newspapers (Seamans and Zhu, 2014). Craigslist’s entry also led to reduced online traffic and posting fees for competing job posting websites (Brenčič, 2016), reduced real estate vacancy rates (Kroft and Pope, 2014), reduced solid waste added to landfills (Fremstad, 2017), and increased price dispersion of secondary concert ticket markets (Bennett, Seamans and Zhu, 2015).

⁸Our paper differs substantially from Chan, Mojumder and Ghose (2018). We investigate the impact of Craigslist on the structure of the prostitution market, and focus on this as a mechanism for investigating associated impacts on women’s safety. In contrast, Chan, Mojumder and Ghose (2018) focus primarily on prostitution services and related trends at the county level.

were associated with ERS than Craigslist entry. For example, while Craigslist entry is positively associated with HIV incidence, one study found that ERS had negative effects on HIV incidence (Chan and Ghose, 2014).

In response to the growth of prostitution advertising on the site, as well as other concerns (e.g., increased human trafficking), Craigslist ultimately shut down ERS amid mounting legal pressure from federal and state government agencies (Miller, 2010). Law enforcement and activists had mixed responses to government shutdowns of online ERS. There were three primary arguments justifying the shut down. First, critics argued that Craigslist both facilitated prostitution transactions through ERS (Delateur, 2016), and made enforcement more difficult.⁹ Second, critics argued that the use of ERS was dangerous for the individuals involved. This argument was based primarily on some infamous cases in which serial killers and murderers targeted sex workers on Craigslist.¹⁰ Third, there was a widespread belief that online platforms were utilized by human traffickers, and their growth and importance were therefore supporting the infrastructure of human trafficking networks (Delateur, 2016). Alternatively, it could be that all or most opposition to internet-mediated sexual transactions is the result of moral repugnance (Roth, 2007, 2018; Gu, Roth and Wu, 2018).

However, these points have been disputed by both law enforcement and sex workers. Some law enforcement officials have suggested that shutting down online ERS made law enforcement more, not less, difficult by dispersing trafficking through more clandestine channels (Mehta, 2017; AP, 2017).¹¹ In addition, sex workers and journalists have argued that ERS shutdowns made sex work more dangerous (Bass, 2014, 2015a).

⁹Thomas Dart, sheriff of Cook county, sued Craigslist because he estimated that between January and November 2008 his department devoted 3,120 man-hours and approximately \$105,081.00 to make 156 arrests (*Thomas Dart, Sheriff of Cook County v. Craigslist, Inc.*, No. 09 C 1385 [Northern District of Illinois Eastern Division District Court, 2009]).

¹⁰At the time of this writing, there is a still-at-large serial killer of Craigslist sex workers operating out of Long Island, New York (Kolker, 2013, 2014). In addition, there are several serial killers currently active who appear to target sex workers, but it is not clear that all of them used Craigslist or Backpage to target the victims (Henry, 2016).

¹¹This argument has some anecdotal support post-FOSTA implementation, with law enforcement reporting that the shuttering of Backpage has made law enforcement more difficult, with officer reporting that "...it has blinded us. We used to look at Backpage as a trap for human traffickers and pimps." (Fischer, 2018)

3 ERS and Market Participant Safety

Illegal sex workers face multiple sources of risk, including risk of arrest, violence from clients and serial killers, and general environmental violence.¹² This high level of risk has led to the emergence of an extensive set of mechanisms (primarily related to screening, the location of solicitation and the coordination of assignation) that market participants use to increase safety. There are multiple segments in prostitution markets, ranging from the primarily higher priced independent “call girl,” to escort agency workers, to street walking sex workers (Reynolds, 1986; Weitzer, 2011).¹³ Segments differ in regards to levels of risk, as well as along numerous dimensions such as the quality of the workers, prices charged, services rendered, and location where services are performed.

Prior to ERS, sex workers had several ways in which to identify, screen, and transact with potential clients. An independent worker could advertise in alternative local print publications (e.g., *The Providence Phoenix*), develop reputation through online “review” websites, such as The Erotic Review,¹⁴ or utilize paid online advertising. As an alternative to working independently, escort agencies provided advertising, screening, and matching services at a monetary cost to the worker. Independent and agency-affiliated workers screen potential customers before agreeing to meet, whereas, in contrast, a street walker has significantly less opportunity to screen before contracting. For this reason, so-called “indoor” prostitution has the potential to be less risky than streetwalking (Weitzer, 2011).

Although opponents argued that ERS made sex workers unsafe, violence against sex workers was not unique to Craigslist ERS transactions. Lowman and Fraser (1995) estimated that a female street sex worker is 60 to 120 times more likely to be murdered than a female non- sex worker. Brewer et al. (2006) explains, “Lone perpetrators accounted for the overwhelming majority of prostitute and client homicides. In these data sets, clients committed 57-100 percent of prostitute homicides, prostitutes committed 86-94 percent

¹²In addition, sex workers are easy prey for sadistic individuals (Warren, Hazelwood and Dietz, 1996), as more than half of all serial killers’ victims have been sex workers (Egger, 2003) and fully one third of all sex worker deaths are due to murder by serial killers (Brewer et al., 2006). The presence of psychopathic homicidal behavior poses a policy problem insofar as these groups of people are not easily deterred.

¹³Some sex workers report working simultaneously across these different segments (Moran, 2015). See Reynolds (1986) for a detailed taxonomy of the historical tiers within the market prior to the Internet.

¹⁴<https://www.theeroticreview.com/>

of client homicides, and pimps committed 40-67 percent of pimp homicides. Serial killers accounted for more than one-third of prostitute victims, and nearly all such serial killers were clients.” Further, the modal victim of a serial killer is a female sex worker, as these make up more than 50 percent of all serial killer victims (Egger, 2003).¹⁵ In light of these risks, careful investigation of whether this technological shock significantly impacted female safety is of utmost importance.

4 Description of Data

We investigate the effects of ERS on market participant safety using four unique datasets. First we collected data on the date on which ERS began operating in each city using the *Wayback Machine* to construct this dataset.¹⁶ Accessing each unique Craigslist website for each city in our dataset, we searched through the city’s history for the first appearance of ERS. The first month in which ERS appeared was considered the first month in which ERS entered a market.

Our second dataset utilizes reviews from *The Erotic Review*, which is a reputation website (similar to Yelp.com), and one of the largest websites devoted to sex work in the United States (Cunningham and Kendall, 2016). Clients use The Erotic Review to share detailed reviews of sex workers. We use these data to measure whether a sex worker worked for an agency or independently, whether the provider provided an incall,¹⁷ the average hourly price,¹⁸ ratings on performance and appearance, and unstructured textual data provided by reviewers. We collected 344,561 unique reviews of 68,450 unique providers reviewed between 1998-2009 from across the United States. Our data contains information on reviews of providers from 185 cities in the United States.¹⁹

¹⁵For a detailed review of the trends in sex workers as victims of serial homicides, see Quinet (2011).

¹⁶The Wayback Machine first started archiving in 1996. It can be accessed at <https://archive.org>.

¹⁷Outcalls are instances where the sex worker travels to meet the client. Incalls are instances where the client travels to meet the sex worker.

¹⁸Price is based on a bundle of female characteristics and sex acts. We look only at the aggregate hourly price for simplicity.

¹⁹Reviews reflect an individual client’s self-reported experience with a specific escort. Reviewers are assumed to be clients who had visited the sex worker and later left a review of her on the website. Reviews remain on the website unless a complaint is made, at which point the offensive review may be removed by administrators. We utilized the calendar date of each review to determine whether the review was posted before or after ERS existed in the market. As reviews are the self-reported statements by individual

Our third set of data is the FBI’s Supplemental Homicide Reports (SHR) for the years 1995-2009. These data contain information on the number of homicides, the gender of the victim and of the murderer, the circumstances of the murder, the weapon used and the relationship between the victim and the murderer (Fox and Swatt, 2014). However, Brewer et al. (2006) notes that sex worker homicides are grossly underascertained in the SHR.²⁰ This appears to be a by-product of the way in which information about the homicide is reported in the SHR. The monthly reporting schedule for participating agencies “requires agencies to report homicides in the month that they are *discovered*, even if that is not the month in which they occurred or if the social context of the homicide is not yet known. Sex worker homicides often go undetected for weeks, months, or years, so the SHR procedures have a built-in bias toward under ascertainment of many prostitute homicides” (Brewer et al., 2006, emphasis added). Thus, we focus on total female homicides for most of our analysis so as to avoid this biased underascertainment problem. Our proxy for female safety is the number of female victim homicides per 100,000 population. We also measure the number of male homicides and the number of females murdered by an acquaintance per 100,000 for our falsification exercise. These data use a total of 402 cities.

Finally, for one of our falsification exercises, we collected data on the number of manslaughters from the FBI’s Summary Uniform Crime Reports Part I, and used jurisdiction-level files from Chalfin and McCrary (2017). These data contain information on 365 cities. Summary statistics for our data are shown in Table 1.

5 Did Craigslist Affect Sex Worker Reviews?

We do not observe the universe of sex services because a representative survey or census of sex workers in the United States does not exist. Review websites have been used in previous studies both as a proxy and because these sites provide an interesting window into the online sex market in their own right (Cunningham and Shah, 2018). We examine the influence of Craigslist on the sex services market by examining its effect on reviews

clients about a specific escort, they are therefore subject to all caveats, such as hindsight bias.

²⁰For instance, there are only 49 such instances of a murder offense named as a prostitution death out of 31,250 observations.

at The Erotic Review.

Our identification strategy uses the staggered introduction of ERS in different cities across the US. For some cities, ERS was present on the day Craigslist entered the market, while in other cities, ERS opened months or even years later. Our approach is similar to the one taken by Kroft and Pope (2014), Seamans and Zhu (2014) and Greenwood and Agarwal (2016), though in each they use the Craigslist platform entry for identification; in contrast, we look at the opening of ERS, similar to Chan, Mojumder and Ghose (2018). Key to our identification strategy is that both Craigslist’s entry into markets, as well as the entry of its ERS section, was *ex ante* unannounced. Assuming the evolution of the prostitution markets in treatment cities would have followed a similar path as control cities, then we are able to identify the causal effect of ERS.²¹

While we do observe when Craigslist introduced ERS in a market, we do not observe whether sex workers used the platform for advertising and solicitation. As such, our treatment estimates may simply be intent-to-treatment measurements. We investigate this more carefully using the email addresses of sex workers reviewed at The Erotic Review. When posting an advertisement on Craigslist, sellers are given a temporary pseudonymized Craigslist-specific email address (e.g., jdst7-5899208383@sale.craigslist.org). If sex workers became more reliant on Craigslist for meeting clients, it is plausible that clients would record the temporary Craigslist email in their review. The pseudonymized email address provides an additional level of identity protection for the worker at the point of solicitation.²² Investigation of the The Erotic Review data shows that there were 129 unique providers whose profile contained a Craigslist email address. We plot this relationship between ERS opening in a market and the use of temporary Craigslist email addresses graphically in the upper left panel of Figure 7. As can be seen, the probability a

²¹One may question whether our dataset has sufficient mass for the post-treatment period given the staggered introduction of ERS by market and month. We represent the number of cities by date before and after the treatment that are contained in our data in Figure 6. The x-axis depicts the number of months until or after the introduction of ERS and the y-axis presents the number of cities that appear in our panel with the recentered treatment value of the x-axis. We believe that there exists sufficient mass for identification in the pre- and post-treatment dates in our estimation.

²²As these are temporary emails, it is equally plausible that clients use the provider’s real email address when interviewing after initial contact and not the temporary Craigslist email. This biases our estimates toward zero, and thus our estimates represent a lower bound.

sex worker had a Craigslist email prior to the introduction of ERS was zero, but increased substantially afterwards. Specifically, the use of Craigslist emails on The Erotic Review became more prevalent approximately 10 months after the introduction of ERS.

Given the 10 month lag between the introduction of ERS and the use of Craigslist emails on TER, we empirically investigated the impact of ERS using the following linear regression model:

$$Y_{mt} = \delta_1 D_{<10,mt} + \delta_2 D_{\geq 10,mt} + \beta X_{mt} + \varepsilon_{mt} \quad (1)$$

where Y is the outcome of interest expressed as a count per 100,000 by market m and month t , $D_{<10}$ is a dummy indicating 0-9 months after ERS opened in the market, $D_{\geq 10}$ is a dummy indicating 10+ months post-entry, X is a matrix of market and month-by-year fixed effects (e.g., January 2001 dummy), and ε is an error term. All models are clustered at the market level to account for within-market serial correlation. Our model attempts to capture both short and long-run effects through the inclusion of two staggered treatment indicators.

Those results are presented in column 3 of Table 2. The effect of ERS opening on the probability of a Craigslist email is statistically significant at the 1-5 percent level. After the 10th month the probability a review contained a Craigslist email had quadrupled over the immediate effect.²³

We also focused on outcomes associated with growth in the size of the internet-mediated market, specifically the effect that ERS had on total reviews and total number of providers. These are both aggregate market-level outcomes. To calculate the aggregate number of reviews, we summed all reviews at the city/month/year level. Columns 1 and 2 for Table 2 report the results from estimating equation (1). We find that in the first ten months, the number of reviews increased 41 percent over the mean, and 67 percent over the mean beyond that point. We also find that the number of unique providers reviewed increased by 29 percent (by market/month) in the first ten months, and then 43 percent beyond that.

²³In addition to using typical cluster robust standard errors, we also constructed empirical p-values using randomization inference. We randomly assigned treatment dates using 1,000 permutations and estimated the probability that chance produced our coefficients. The effects were significant at the 5-10% level.

Next we examine the effect that ERS had on intermediary composition. We have two measures of firm intermediary in The Erotic Review: whether a provider works through an agency and whether they are independent, or self-employed. We find robust evidence that ERS led to a change in the employment characteristics of sex workers reviewed at The Erotic Review. In the first 10 months, the probability a sex worker was independent rose 6.5 percent, which is 12 percent of the mean. This effect persisted in the long run, as evidenced by the positive and statistically significant 10+ month coefficient. This increase in the probability of being independent is associated with a declining probability of agency employment. We suspect that this reversal is coming both from agency workers becoming independent, but maybe more importantly, a transition of women moving indoors who are otherwise unaffiliated with agencies. One can see this transition with graphical evidence in Figure 7. The introduction of ERS into markets had a profoundly negative effect on the vertical integration of workers with agencies suggesting that ERS reduced transaction costs (Williamson, 2002) or simply led to an introduction of sex workers who were unaffiliated with agencies.

6 Did Craigslist Increase Market Participant Safety?

Sex workers have claimed that their safety increased after the ERS platform opened in their markets, but some activists and law enforcement dispute this claim. Knowing whether ERS negatively or positively affected female safety is therefore an empirical question. In this section we examine the effect of ERS on female homicide rates. Since female homicides are infrequent at the city/month level, we estimate equation (1) using both OLS and a Poisson specification.²⁴ We estimate equation (1) using the OLS specification in columns 1-3 and using the Poisson specification in columns 4-6 of Table 3. In our OLS model, we estimate the effect of ERS on the number of female homicide cases per 100,000

²⁴We also estimated the effect using two common transformations of the female rate itself: the quartic root and the inverse hyperbolic sine. Our results are robust to either transformation and available upon request. Our Poisson model becomes:

$$E[Y_{mt}|D_{<10,mt}, D_{\geq 10,mt}, X_{mt}] = \exp(\delta_1 D_{<10,mt} + \delta_2 D_{\geq 10,mt} + \beta X_{mt}) \quad (2)$$

where all variables are defined the same as equation (1). All analyses allow errors to be correlated within cities over time when estimating standard errors (Bertrand, Duflo and Mullainathan, 2004).

and thus, the interpretation of our coefficient is as a marginal effect on the rate. In our Poisson model, the interpretation of our coefficient is as a semi-elasticity.

6.1 Impact on Female Homicides

ERS would have increased violence against women if Craigslist was either more dangerous than the alternative, or the incidence of violence was increasing in the size of the market (Schapiro and Alpert, 2011). But, the fact that sex workers voluntarily selected into the Craigslist platform suggests that there was some reduction in cost, and potentially that includes safety, or at least perceptions thereof (Grant, 2009).

In column 1 of Table 3, we report results controlling for city fixed effects and month-year fixed effects (e.g., August 2000, September 2000, etc.). We find that ERS is associated with a longrun reduction of 0.019 female homicides per 100,000, which is a 14.6 percent reduction from the mean. In column 2, we also control for state-year fixed effects (e.g., California in 2000, etc.) which forces identification to come from comparisons within state-year. This causes the longrun coefficient to fall to -0.015 but remains significant at the 5 percent level. Finally, we include a control for city level population, which further brings the longrun coefficient down to -0.013 which is a 10 percent reduction in female homicide rates from a mean of 0.13. In column 4-6 we repeat these model specification using Poisson and find similar effects in magnitude and precision.

Next we examine the sensitivity of our analysis to the defined treatment windows. We examine 6-month, 9-month and 12-month longrun definitions and report those analysis in Table 4. Note that the 10-month window is the most conservative estimate of longrun effects. All other effects are either the same (6 month) or slightly larger and more significant.

The underlying research design behind equation (1) is differences-in-differences. The key identifying assumption for a differences-in-differences strategy is the claim that absent the intervention, female homicide rates would have evolved similarly in treatment and control units across the point of the intervention itself. This is fundamentally an untestable assumption because the counterfactual post-treatment evolution of homicide without ERS is unobserved for treatment units. But we can evaluate whether such a dy-

namic existed in the pre-treatment period by focusing on a sequence of leads. We examine this by estimating the following model:

$$Y_{mt} = \sum_{j=2}^6 \gamma_j L_{m,t-j} + \sum_{i=1}^8 \delta_i D_{m,t+i} + \beta X_{mt} + \varepsilon_{mt} \quad (3)$$

where L_{mt} is five ten-month pre-treatment dummies and one pre-50 month dummy, and D_{mt} are seven post-treatment ten-month dummies²⁵ and one post-70 month dummy.²⁶ We present coefficient boxplots with 5th and 95th percentile confidence intervals from our OLS and Poisson regression in Figure 8 for easier interpretation given the large number of coefficients. As can be seen, the effect of ERS on female murders is a long-term negative effect starting at approximately the tenth month. Importantly, there is no statistical difference between the treatment units and the control units in the pre-treatment period. Coefficient estimates are nearly zero in three of the five estimates and always with large standard errors.

We conducted a test on the joint significance of the leads and lags, as well. The joint significance of the lags summing to zero can be rejected at $p < 0.01$ whereas the same test on the leads is significant at $p < 0.9$ in the OLS model, and similar levels of precision for the Poisson model.

We can calculate the number of saved female lives using a back-of-the-envelope calculation. Using the year prior to the introduction of ERS (2001) as our base year, we compute the number of total homicides at 1,754 total female homicides in our sample of cities. We then shrink this number by 10 percent which gives us 175 fewer murders as a result of ERS. Multiplying 175 fewer murders by eight years, we estimate approximately 1,400 fewer murders resulting from the introduction of ERS.

Are these magnitudes plausible? It is difficult to answer this question given that the true incidence of prostitution homicides is unknown. Most datasets do not record whether

²⁵We chose 10-month because it appears that the Craigslist email results suggest a 10-month lag (See Figure 7). We re-estimated our models using 6-month, 9-month, and 12-month dummies. The results do not change much. The significance is always on the lagged effect, and the precision is always p-values of 0.010 to 0.016. Shorter lag time is never significant: p-values range from 0.641 to 0.970. The effect sizes get larger with the lag.

²⁶We combine the last dummy so that all coefficient plots can be seen on the same graph. The omitted variable is the ten months just prior to treatment.

a female victim of a homicide was a sex worker, and those that do suffer from severe underascertainment biases built into the data collection methods. To our knowledge there is only one study that has attempted to estimate the incidence of prostitution homicide as a share of female homicides (Brewer et al., 2006). The authors concluded that 2.7 percent of all female homicides are prostitution deaths by clients. But this study has significant limitations. It is based on select data only from Chicago, St. Louis, Washington state, North Carolina, the SHR, 33 urban counties for one cross-section, and Colorado Springs. The issue of underascertainment bias would conceivably hold, and maybe more so, for this select sample. Thus we interpret their estimates to be, at best, a lower bound. Our estimate of a 10 percent reduction in female homicides does suggest, though, that ERS created an overwhelmingly safe environment for female sex workers — perhaps the safest in history.

7 Robustness

We employ three robustness exercises on our primary female homicide result. First, we implement randomization inference on our linear fixed effects model to determine if the estimated treatment effect is robust when we consider randomly assigning treatment dates to city. Fisher (1935) argued that permutations of all possible treatment assignments provides a reasoned basis for testing the null hypothesis that there is no effect while avoiding distributional assumptions such as normality. Young (2018) notes that this Fisherian approach has some additional relevance in finite samples since its validity is not dependent on asymptotic theorems. Comparative case study approaches to causal inference have also noted the suitability of randomization inference when estimation uncertainty is the result of unknown counterfactuals as opposed to sampling uncertainty (Abadie, Diamond and Hainmueller, 2010; Buchmueller, DiNardo and Valletta, 2011). This is particularly relevant in our context because our data are all reported homicides by police jurisdictions choosing to submit to the UCR, not merely a sample. Thus there are many reasons to include randomization inference in our analysis.

Our randomization is as follows. Using the exact number of groups who received treat-

ment dates, we randomly assign treatment dates to cities. This essentially randomizes treatment *profiles* across panel units. We then estimate the effect of ERS on female homicide rates conditional on city, month-year, state-year and city population fixed effects. We repeat this exercise 1,000 times and save the coefficients on short and longterm exposure to ERS from each regression. We then merge all 1,000 coefficients with the true effect creating a sample of 1,001 observations where each observation is a regression coefficient for the shortterm exposure and the longterm exposure. We find that the estimated effect of -0.013 from a mean of 0.13 female homicides per city-month (a 10 percent reduction) is statistically significant at the 8% level, where significance is the coefficient’s rank order divided by 1,001. We present our results from this analysis in both Table 5 and Figure 9. This is an interesting result in a sense for it suggests that the decline in female homicides is uniquely associated with the precise structure of actual treatment dates assigned across cities.

The second robustness check is a re-estimation of the treatment effect using matrix completion methods for panel data (Athey et al., 2018). Machine learning methodological approaches to causal inference is a rapidly growing area, and matrix completion is a recent application created for panel settings. The application of matrix completion to causal inference is natural given the potential outcomes framework explicitly frames the fundamental problem of causal inference as a missing data problem.

Imagine we could create two matrices of potential outcomes: a matrix of Y^0 potential outcomes for all panel units over time representing female murder rates without ERS, and a matrix of Y^1 potential outcomes for all panel units over time representing female murder rates with ERS. At any point in time, we observe only one of these potential outcomes for a city which creates numerous missing values. Missingness here is simply another perspective on the fundamental problem of causal inference - there is never a complete matrix because counterfactuals are always missing. If we were interested in estimating the average treatment effect for the treatment group, then we’d be estimating:

$$\widehat{\delta_{ATT}} = \frac{1}{N_T} \sum (Y_{it}^1 - Z_{it}^0) \quad (4)$$

where Y^1 are the observed murder rate outcomes in cities with Craigslist ERS, Z^0 are the *estimated* missing elements of the Y^0 matrix for the post-treatment period and N_T is the number of treatment units. Matrix completion estimation uses the observed elements of the matrix of realized values of the Y^0 potential outcomes matrix to predict the missing elements of the Y^0 matrix, which are missing because in the post-treatment period we only observe Y^1 .

Analytically, the imputing of missing counterfactuals is done via regularization based prediction. The objective in this approach is to optimally predict the missing elements of the matrix of potential outcomes by minimizing a convex function of the difference between the observed matrix of Y^0 and the unknown complete matrix Z^0 using nuclear norm regularization. Letting Ω denote the row and column indices, (i, j) , of the observed entries of the outcomes, and the unknown matrix Z to be estimated, the objective function can be written as:

$$\widehat{Z}^0 = \arg \min_{Z^0} \sum_{(i,j) \in \Omega} \frac{(Y_{it}^0 - Z_{it}^0)^2}{|\Omega|} + \Lambda ||Z^0|| \quad (5)$$

where $||Z^0||$ is the nuclear norm (sum of singular values of Z^0). The regularization parameter Λ is chosen using 10-fold cross-validation. Athey et al. (2018) show that solving for the missing counterfactual using this matrix completion problem exploits richer patterns in the data and using extensive simulations show that the method outperforms other methods in terms of root mean squared prediction error.²⁷ We report the results from this analysis in Table 6. Here we report the entire ATT, which is -0.023, which is equivalent to a 17.6 percent in female homicide rates. We experimented with a dozen different seeds for our bootstrapping, and the p-values were consistently very small ranging from 0.008 to 0.028 with a median p-value of 0.015.

Finally, we examine the effect of ERS on females killed by acquaintances and intimate partners, male homicides, and manslaughters. As none of these are directly associated with sex markets or mechanisms originating from the sex markets, there should be no impact of ERS on them. We present those results in Table 7. Although several coefficients

²⁷We utilize the *gsynth* package (see <https://cran.r-project.org/web/packages/gsynth/index.html> for more information about the *R* package) to determine the missing components of the matrix.

are large, none are statistically significant.

8 What is the mechanism linking ERS to decreased murders?

Given the robustness of our homicide result, we investigated The Erotic Review more carefully to determine whether there was any evidence for screening and shifting away from higher risk activities. We focus on several measures which we believe can help shed light on our results.

Before we present our results, we discuss the layout of Table 8. Panel A uses the same specification in equation (1). These estimates all represent changes in mean values associated with entry. In Panel B we estimate the effect of ERS on entrants only. Entrants were defined as providers whose first review was 0-10 months post-ERS opening in their city, 10-20 months, and so on. To estimate the marginal effect of ERS on marginal entrants, we estimated the following equation:

$$Y_{imt} = \sum_1^6 \delta_{t+\tau} E_{i,t+\tau} + \sum_1^6 \gamma_{t+\tau} D_{m,t+\tau} + \beta X_{mt} + \varepsilon_{imt} \quad (6)$$

where E_{it} is an indicator equaling one if the respondent appeared in our data after ERS (and in which band of months) and D_{mt} is an indicator equaling one for each of the time bands. We report estimates for δ_t in Table 8 Panel B for each outcome.

We propose three mechanisms that link ERS to declining violence. Our possible mechanism is that ERS leads to greater market efficiency which leads to more repeat business (or both). We call this the “efficiency effect”. The second possible mechanism is that the sex worker’s work environment is becoming safer due to sex workers moving solicitation itself from outdoor street work to indoor work. We call this the “composition effect”. The composition effect speaks to changes in entry, while the efficiency effect speaks to changes in the matching technology linking sex workers with clients. The final mechanism is that the Internet allows for the sex worker to increase screening, which we call the “screening effect”. We can evaluate both of these, albeit somewhat indirectly.

8.1 Efficiency Effect

The efficiency effect is simply a product of declining search costs and otherwise more effective matching through the availability of rich information about both sides of the market. Insofar as sex workers are able to sort into repeat working relationships with safe clients, then the propensity to experience victimization may fall. On the other hand, the effect may move in the opposite direction if declining search costs scale up the market to such a point that despite declining probabilities of violence, the absolute effect is positive.²⁸

To evaluate the efficiency hypothesis, we searched client reviews and classified a review as referring to “repeat” business if it contained the words “repeat” or “regular”. Approximately 15 percent of the sample were described by such reviews. Indeed, the introduction of ERS is associated with a higher probability that a review contains this sort of language — by 2 percent in the first ten months, and 2.7 percent thereafter. When we look at the effect that ERS had on entrants, though, we find very weak evidence that their behavior was noticeably different than incumbents. This suggests that ERS affected incumbents and entrants equally with regards to forming repeat liaisons with clients. And this suggests that the *need* to screen may in fact be falling simply as an artifact of improved matching in a market with considerably lower search costs and better matching functions.

8.2 Composition Effect

Evidence for women transitioning indoors and online is more difficult because we do not observe whether a woman is a street sex worker; only that she appears in the The Erotic Review database and at what point her first review occurred. But, we reason that if in fact there was an increase in street prostitution moving indoors and online, then we would expect the composition of The Erotic Review to present evidence of negative selection. This is because street sex workers are believed to fall on a lower rung of the informal sex

²⁸Consider an analogy involving automobile safety and aggregate traffic fatalities. As cars have gotten safer and more affordable, more people buy them and more accidents happen, even though the probability of an accident has fallen even putting aside any potential moral hazard raised by other authors (Peltzman, 1975).

market and may perhaps be less attractive.²⁹

We look for evidence of this along several quality dimensions. First, we look at the effect that ERS had on appearance and performance ratings. Reviewers rated each worker on a scale of 1 to 10, with 10 being the highest measure of satisfaction. We find that ERS reduced the mean score slightly by 0.053 in the first ten months, and 0.131 after ten months. This effect became even more pronounced over time when we focus only on the entrants. After the introduction of ERS, entrant appearance worsened relative to incumbents, suggesting that the marginal sex worker was being drawn from a less professionalized pool of women. We also evaluated the impact it had on performance ratings — like appearance, ERS reduced the ratings on performance given by clients at the mean, but particularly for the entrants. Customer satisfaction can also be measured using a question that asked clients to state whether the experience was “as promised.” This kind of *ex post* satisfaction measure is indicative of having one’s expectations met. Here we find no effect on the population as a whole, but we do find large, negative effects among the entrants. We also looked at whether the sex worker provided a real photo; while again we find no effect for the population as a whole, we do find large negative effects among entrants. We examine a myriad of measures for quality, such as performance and meeting expectations, and they all indicate that the marginal entrant is significantly worse than the existing population of sex service providers.

While we cannot measure street prostitution experience directly, we can measure whether the word “street” appeared in a review. Over 6,000 reviews contained the word “street,” and while not all of these appear to describe a street sex worker, a large number do. Such examples include a description that a woman appeared to be “street-like”. We find that the introduction of ERS is associated with a negative occurrence of street mentions in a review. This suggests that the incidence of reviews with street mentions began disappearing with ERS. But, an interesting pattern emerges when we examine the effect of ERS on the characteristics of marginal entrants. All of the coefficients on the entrant variables are positive, and two are significant, suggesting that while ERS is associated

²⁹Scott (2002) notes that “street prostitutes have lower status than sex workers who work indoors. They are often in some state of personal decline (e.g., running away from abusive situations, becoming drug dependent, deteriorating psychologically, and/or *getting less physically attractive*)” (emphasis added).

with a negative mention of streets in reviews, entrants receive these mentions more often. This is further evidence that the marginal entrants were street sex workers.

Transitioning indoors could also show up as a change in the location that sex workers meet with clients. We examine this by using a field where clients stipulated whether a meeting place occurred at his location (outcalls) or hers (incall). Outcalls have the potential for risk because the sex worker is in a foreign and unknown situation with a potentially unknown male (Bass, 2015*a*). As ERS has the potential to improve worker safety, it could increase the number of outcalls made, because of this reduction in risk (Peltzman, 1975). But we find economically large and statistically significant effects of ERS on the likelihood a reviewed sex worker provided incall services. Incalls increased by 4.9 percent in the first ten months, and 8.7 percent after that. But interestingly, this positive effect does not hold for the entrants. Entrant incall probabilities fall slightly after about the 41st month relative to incumbents. This is evidence that the marginal streetwalker is moving indoors — these women are, incidentally, the same women that are more inclined to take on outcall services.

Evidence for negative selection into the Internet mediated market may also show up in lower prices. Lower prices could be a reflection of supply and demand shifts, but it's also a reflection of the Internet drawing in women from the streets where prices are substantially lower. We examined this by investigating the impact of ERS on the sex worker's hourly adjusted price. We find strongly significant and economically meaningful declines in average prices per hour associated with ERS. The average hourly price fell by \$6.62 in the first ten months and then to \$14.82 after that. This effect is more pronounced among the entrants, though, whose prices are lower within 11-20 months after ERS opened.³⁰ The drop in price that we find appears to be much higher for entrants than for incumbents.

We also find that they were relatively less likely to offer incall services, even though the net effect for the post-treatment period is an increase in total incalls. This, again, suggests heterogeneity, since outcalls are higher risk. Altogether, these Panel B estimates are suggestive of the fact that the marginal entrant is a woman entering the indoor market

³⁰But as mentioned, is also entirely possible that the decline in price is due, not to heterogeneity and selection, but through an expansion in supply.

from a lower tier. We interpret these results as suggesting that despite the lower incidence of screening by entrants compared to incumbents, the reduction in homicides is likely a function of a combination of the efficiency and composition effects.³¹

8.3 Screening Effect

Screening is one of the main ways that a sex worker manages the risks of seeing a new client. These methods are diverse and include formal registrations, such as white lists, circulated black lists of bad clients, as well as informal methods such as background checks and calling new clients at work (Cunningham and DeAngelo, 2017).³² The ideal dataset to check for whether ERS led to more screening would be a panel of sex workers, or at worst a repeated cross section, in which we observe the decision to screen. Survey data shows that approximately 60% of Internet-mediated sex workers do in fact use references or some other method of screening, but these data are not available in a repeated cross-section (Cunningham and DeAngelo, 2017). This ideal data to our knowledge doesn't exist, so we move to what is available in TER. Clients wrote extensive reviews about each woman they visited and these reviews sometimes contained references to whether they had been *knowingly* screened. But it is important to note that we only observe individuals who successfully overcame the screening stage, and we only have mentions of screening *if* they client knew he had been screened and chose to mention it.

But, insofar as the marginal entrant into sex work was a former street sex worker, she had previously screened very little to none at all. This is because street solicitation requires quick decisions which leaves little time for collecting information about the client. Thus, if she screens at all, and is a former street sex worker, then it is likely that she was screening more than she would have had she remained on the street.³³ Thus we think we

³¹While we do not ultimately find evidence for screening, we suspect that insofar as the declines in female homicides are a function of ERS expansion, then increased screening remains a plausible first order cause of the decline. The reason being, streetwalkers do not screen much at all. So if they are moving indoors, and this movement indoors causes a decline in risk, then it must be because Internet advertising and matching must be making it more difficult for clients to assault sex workers. The most likely explanation is that they are screening. But we ultimately are unable with these data to find evidence for this.

³²See https://www.theeroticreview.com/info_policies/whiteListFAQ.asp.

³³It is worth emphasizing that shifting street workers indoors has two dimensions. First, it may be that contemporary streetwalkers move indoors. Second, as the platform establishes a way for sex workers

are biased against finding impacts using TER data.

We measure screening using textual analysis and search for language in the client reviews correlated with screening such as “refer,” “reference,” “screen,” “white list,” and the names of specific screening services (e.g., p411).³⁴ Roughly 5 percent of the reviews contained such language.

We ultimately find no direct evidence for it in Table 8, Panel A, the last column labeled “Screen”. There’s no effect in the first ten months, and a slightly negative but insignificant effect for the 10+ month period. This suggests that ERS does not change the frequency with which matched clients knowingly experienced screening.

However, when we evaluate the effect that ERS had on new entrants’ screening choices, we find a different pattern. New entrants were considerably less likely to screen when ERS entered, and this effect grew with time. This suggests that the women moving indoors and online were typically women with lower tendency to screen compared to incumbents. This does not mean that marginal entrants are decreasing their screening; only that they screen less than their incumbent counterparts. All that we can say is that screening as a practice did not lead to clients reporting an increase its occurrence on The Erotic Review when ERS was introduced to an area, and that entrants screened less than incumbents, comparatively speaking. This could be supported by workers joining only after online screening practices were in place and creating more broadly increases in safety. That increase in safety may therefore induce the marginal sex worker to enter as well.

9 Discussion and Conclusion

In this study, we find that the expansion of Craigslist’s ERS was associated with declines in female homicide rates. We speculate that this may be driven by increased screening, greater efficiency in the market, and the shifting of sex workers from street locations with greater environmental hazards (Cunningham and Kendall, 2011*a*). While we do not find evidence for the screening effect, we do find evidence consistent with the efficiency and

to work indoors, then each wave of potential streetwalkers will simply sort directly indoors skipping the street altogether.

³⁴We also modify this classification by building a classifier that accounts for negations and other potential confusion (e.g. *preference* instead of *reference*).

composition effects.

The findings in this paper point to several potential positive impacts of allowing illicit sex workers to solicit through an online platform that enables improved efficiency and changes in the composition of the indoor/outdoor markets. One of these benefits is cost-effectiveness. Putting the magnitudes into context, we compare our estimates to the cost of achieving the same reductions in murders using an alternative mechanism: the hiring of additional police officers. How many more police officers would need to be hired to reduce female homicides by 10 percent?

Evans and Owens (2007) estimate the police-murder elasticity to be -0.84, which implies a police force employment increase of 12 percent.³⁵ We calculate the size of this counterfactual police force expansion using data from the 2001 LEOKA data (the year prior to ERS opening in the San Francisco Bay area), and aggregate the number of police and the size of the population. In total, there were 1,003,441 total police employed, a population of 289,627,938 in 2001, and the number of police per 100,000 equalling 346.5. To find the number of additional police, we increase the police by 12 percent which gives us 1,123,854 employed police officers, an increase of 120,413 police officers. Assuming an annual outlay of \$100,000 per officer, reducing female homicides by 10 percent would cost society an additional \$12 billion per year using higher levels of police employment. Craigslist ERS achieved the same result, in other words, and saved 1,400 female lives at a fraction of the cost of doing so using an increase in policing.³⁶

Our study suggests that dialog must occur regarding the costs and benefits of anti-ERS enforcement. We suspect that this dialog is likely to require more nuance and sensitivity than has previously been the case, though, as ERS may increase the size of the prostitution market while simultaneously reducing violence. For example, we find strong evidence that ERS increased the proportion of independent sex workers and the number of reviews at

³⁵Using the definition of elasticity, $-0.84 = \frac{-0.10}{P}$ if $P = 0.12$.

³⁶The most likely costs would be any welfare loss associated with repugnance and increased sex trafficking (Elias, Lacetera and Macis, 2015; Cho, Dreher and Neumayer, 2011). But if ERS is making prostitution less visible, then it should be reducing repugnance-related costs, not increasing it. The impact on trafficking is ambiguous on the other hand. Insofar as domestically trafficked women never become dependent on intermediaries in the first place, due to improved independent options, then ERS would reduce trafficking. All we can say is that the net effect is a reduction in homicides - including presumably that of trafficking women.

The Erotic Review, even as it reduced violence against women.

ERS had a major disruptive effect on the illicit market for commercial sex in the United States despite the nation’s prohibition of prostitution. It is likely that ERS reduced many dimensions of risk and this, in turn, was responsible for both the market’s growth and the decline in violence. More detailed investigation into the effect of ERS on serial killer activity in the US would potentially provide considerable value for understanding the repercussions of ERS in specific areas. There is still a great deal of research required in this area.

In addition, there are other important issues relating to the relationship between technology and sex markets that have not been analyzed. One opportunity for future research is the relationship between ERS and incidence of human trafficking. Unfortunately, the data does not presently exist that would enable us to answer this question.

9.1 Potential Impacts of FOSTA

On April 11, 2018, President Donald Trump signed into law the Fight Online Sex Trafficking Act (FOSTA) which directly amended §230 of the Communications Decency Act. FOSTA removed the amnesties websites enjoyed under CDA §230 by making websites criminally responsible if their website was used to facilitate prostitution or sex trafficking. Penalties were upwards of ten years in prison. Contemporaneous to its signing, the DOJ seized Backpage and arrested numerous employees including top executives.

Almost overnight, the elaborate network of websites facilitating illegal sex markets was disrupted – from extremely influential websites shutting down to prominent sites blocking US-based IP addresses. As the closure of the sites occurred across the country at the same time, a differences-in-differences research design like ours cannot be performed to understand the impact that the law has had on public safety. The data itself is still years away from being made available for research. At present, we only have personal accounts made public through qualitative representation. Several newspaper reports suggest that FOSTA has indeed made sex workers’ lives more dangerous by pushing them towards street work and pimps, as well as by removing screening as a convenient tool for predicting client violence (McCombs, 2018; Witt, 2018). Even police are reporting an increase in

street prostitution following FOSTA.³⁷

FOSTA supporters hope that by shutting down Backpage, Craigslist’s successor, as well as the myriad of websites pertinent to the illicit market, coercive sex work will be fundamentally disrupted. But the disruption of sex trafficking is not theoretically obvious under FOSTA. First, FOSTA did not provide resources to fragile families, so victims of abuse including runaway teens do not receive direct or indirect assistance such as housing. Thus the supply chain containing domestic trafficked victims is not disrupted by FOSTA. Second, whereas prior to FOSTA victims of trafficking could be identified and recovered at least in principle since they were trafficked on visible platforms, it is unclear that that can happen as often or as easily under FOSTA. Whereas children were recovered when police identified them on Backpage and Craigslist, it may be increasingly difficult to reunite them with families if solicitation moves to more clandestine solicitation channels.³⁸

Another prediction is possible - one that is considerably bleaker than that painted by hopeful legislators, celebrity activists and some law enforcement. Insofar as FOSTA represents a major disruption in the matching markets linking safe clients to sex workers, then we might anticipate two effects. First, the marginal sex worker will leave the market if FOSTA causes her profits to become negative. Exiting may also be sub-optimal if the next best alternative is considerably worse from the worker’s perspective. Thus we expect some exit under FOSTA, though how much depends on the elasticity of supply. Exiting sex workers following FOSTA are by definition the most elastic group of workers in part because they have alternatives which they find relatively acceptable. The women who do not or cannot exit are inelastic to FOSTA because they lack such outside options, and we expect that for these inframarginal sex workers, hardships under FOSTA will be considerable, which may include choosing to work with pimps, falling into predatory

³⁷Lt. Jimmy Sides of the San Antonio police told the Associated Press “I have seen a group of fresher faces, so that would make me think that they’re new to the street, maybe from the internet? (Villarreal, 2018). Similar accounts were given by Phoenix police, who have experienced a “surge in street-prostitution arrests in 2018”, and Houston.

³⁸Sgt. John Daggy, an undercover officer with Indianapolis’s vice unit, told journalists that “with Backpage, we would subpoena the ads and it would tell a lot of the story. Also, with the ads we would catch our victim at a hotel room, which would give us a crime scene. There’s a ton of evidence at a crime scene. Now, since [Backpage] has gone down, we’re getting late reports of them and we don’t have much to go by” (Fischer, 2018).

relationships with traffickers, and facing heightened risk of death and physical violence at the hands of unsafe clients who may have gained the upper hand without adequate screening.

In summary, we find support for sex workers’ claims that the introduction of ERS made them significantly safer. We estimate that ERS led to a 10-17 percent reduction in female homicides. These negative effects on female homicides are consistent with theoretical predictions made by Logan and Shah (2012) and Persson and Lee (2016), suggesting that Internet platforms like Craigslist’s ERS improved market (and potentially non-market) participant safety. While opposition may persist despite these gains due to “distaste for certain kinds of transactions” (Roth, 2007; Gu, Roth and Wu, 2018), or because prostitution is viewed as equivalent with sex trafficking, the potential improvements in female safety illustrated by our results suggest that it is important for policymakers to design policies that might improve the lives of trafficked victims without simultaneously harming others.

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Table 1 Summary Statistics for the Craigslist sample (1995-2009)

Variables	Mean	Std. Dev	N
Female homicides per 100,000	0.13	0.39	54,424
Total reviews	85.65	126.86	4,150
Total providers	18.77	24.76	4,150
Craigslist email	0.002	0.04	68,450
Independent	0.56	0.50	68,450
Agency	0.34	0.47	68,450
Incall	0.84	0.36	68,450
Delivered as promised	0.87	0.33	68,450
Real photo	0.79	0.41	68,450
Hourly price	\$294.33	173.51	344,399
Screening	0.05	0.22	344,561
Repeat	0.15	0.37	344,561
Looks rating	7.46	0.98	344,561
Performance rating	7.32	1.42	344,561
Street	0.02	0.14	344,561
Female homicides from acquaintance killer per 100,000	0.03	0.13	54,272
Male homicides per 100,000	0.50	0.83	54,272
Manslaughters per 100,000	0.01	0.14	51,168

Table 2 The effect of Craigslist's erotic services openings on production and intermediary characteristics

Dep var:	Reviews	Providers	Craigslist	Independent	Agency
ERS (first 10 months)	35.167** (14.579)	5.519** (2.463)	0.001** (0.000)	0.065*** (0.024)	-0.069** (0.031)
ERS (post-10 months)	56.919** (25.502)	8.049* (4.424)	0.004*** (0.002)	0.058* (0.033)	-0.073* (0.039)
N	4,150	4,150	68,450	68,450	68,450
Mean of dependent variable	85.65	18.77	0.00	0.56	0.34

Outcomes are binary variables equalling one if the vendor had the ascribed characteristic. Models control for city and date fixed effects. Robust standard errors clustered within city in parenthesis. * p<0.10, ** p<0.05, *** p<0.01

Table 3 FE estimates of the effect of erotic services openings on female murders per 100,000

Dep var:	Female Murders					
	1	2	3	4	5	6
ERS (first 10 months)	-0.007 (0.008)	-0.007 (0.008)	-0.006 (0.008)	-0.075 (0.064)	-0.064 (0.068)	-0.059 (0.068)
ERS (post-10 months)	-0.019** (0.008)	-0.015** (0.007)	-0.013* (0.007)	-0.191*** (0.070)	-0.135** (0.067)	-0.124* (0.067)
N	54,424	54,424	54,272	54,424	54,424	54,272
Mean of dependent variable	0.13	0.13	0.13	0.13	0.13	0.13
Estimation method	OLS	OLS	OLS	Poisson	Poisson	Poisson
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	No	Yes	Yes	No	Yes	Yes
Population	No	No	Yes	No	No	Yes

Outcome variable comes from the Supplemental Homicide Reports. Cluster robust by city standard errors are shown in parenthesis. * p<0.10, ** p<0.05, *** p<0.01

Table 4 FE estimates of the effect of erotic services openings on female murders per 100,000 using varying windows

Dep var:	Female Murders					
	1	2	3	4	5	6
ERS (first 6 months)	-0.003 (0.010)			-0.032 (0.081)		
ERS (post-6 months)	-0.013* (0.007)			-0.123** (0.063)		
ERS (first 9 months)		-0.004 (0.008)			-0.041 (0.071)	
ERS (post-9 months)		-0.015** (0.007)			-0.142** (0.066)	
ERS (first 12 months)			-0.005 (0.007)			-0.052 (0.065)
ERS (post-12 months)			-0.016** (0.007)			-0.157** (0.069)
N	54,272	54,272	54,272	54,272	54,272	54,272
Mean of dependent variable	0.13	0.13	0.13	0.13	0.13	0.13
Estimation method	OLS	OLS	OLS	Poisson	Poisson	Poisson
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Population	Yes	Yes	Yes	Yes	Yes	Yes

Outcome variable comes from the Supplemental Homicide Reports. Cluster robust by city standard errors are shown in parenthesis. * p<0.10, ** p<0.05, *** p<0.01

Table 5 Estimated effect of Craigslist entry on female homicides per 100,000 using linear FE with randomization inference with 1000 draws

Dependent variable: Coefficient:	Female murders	
	0-10 months	10+ months
True effect	-0.007	-0.013*
5th percentile	-0.014	-0.016
95th percentile	0.015	0.015
Two-tailed test p-value	0.23	0.08
N	53,576	53,576
Procedure	OLS	OLS

These are FE regressions using the Supplemental Homicide Reports. The model is linear fixed effects with 1,000 randomized permutations for creating the sampling distribution. Controls include city fixed effects, year-month fixed effects and state-year fixed effects. The panel presents 5th and 95th percentile confidence intervals from permutations tests and p-values from a two-tailed test. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6 Matrix completion estimation of ERS on female homicide rates

Dependent variable: Female murders	
ERS	-0.023** (0.010)

Matrix completion model with 10 folds for cross validation and 1,000 draws for bootstrapped standard errors. Model includes city and month-year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7 Falsification exercises: examining ERS effect on females killed by intimates, male homicides and manslaughters

Dep var:	Females by intimates		Males		Manslaughters
ERS (first 10 months)	0.001 (0.003)	-0.002 (0.134)	-0.017 (0.016)	-0.030 (0.037)	-0.001 (0.003)
ERS (post-10 months)	0.003 (0.003)	0.107 (0.148)	-0.023 (0.026)	-0.057 (0.057)	0.002 (0.004)
N	54,272	54,272	54,272	54,272	51,168
Mean of dependent variable	0.03	0.03	0.50	0.50	0.01
Estimation method	OLS	Poisson	OLS	Poisson	OLS
City FE	Yes	Yes	Yes	Yes	Yes
Month-Year FE	Yes	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes	Yes
Population	Yes	Yes	Yes	Yes	Yes

Outcome variable comes from the Supplemental Homicide Reports. Cluster robust by city standard errors are shown in parenthesis. Poisson was unable to converge for the manslaughter regression.* p<0.10, ** p<0.05, *** p<0.01

Table 8 The effect of Craigslist's erotic services openings on characteristics of entrants

Dep var:	Panel A								
	Repeat	Looks	Performance	Street	As promised	Real photo	Incall	Price	Screen
ERS (first 10 months)	0.020** (0.009)	-0.053* (0.030)	-0.066* (0.034)	-0.003* (0.001)	-0.001 (0.012)	-0.009 (0.015)	0.049*** (0.013)	-6.624* (3.555)	0.000 (0.004)
ERS (post-10 months)	0.027** (0.013)	-0.131*** (0.049)	-0.110* (0.064)	-0.003* (0.002)	0.004 (0.018)	-0.022 (0.020)	0.087*** (0.024)	-14.823** (6.246)	-0.005 (0.007)
Panel B									
Entrant 0-10mo post ERS	0.004 (0.004)	-0.122*** (0.035)	-0.489*** (0.063)	0.000 (0.001)	-0.051*** (0.011)	-0.099*** (0.015)	-0.038*** (0.009)	-17.226*** (5.100)	-0.002 (0.002)
Entrant 11-20mo post ERS	0.011** (0.004)	-0.074** (0.033)	-0.430*** (0.042)	0.004*** (0.001)	-0.049*** (0.014)	-0.065*** (0.017)	-0.006 (0.015)	-11.016** (5.410)	-0.006** (0.003)
Entrant 21-30mo post ERS	0.005 (0.003)	-0.170*** (0.028)	-0.469*** (0.037)	0.001 (0.002)	-0.054*** (0.010)	-0.039*** (0.011)	-0.007 (0.008)	-21.764*** (6.888)	-0.002 (0.002)
Entrant 31-40mo post ERS	0.004 (0.006)	-0.137*** (0.024)	-0.547*** (0.041)	0.002 (0.002)	-0.055*** (0.010)	-0.046*** (0.010)	-0.011 (0.009)	-13.644** (5.684)	-0.012*** (0.003)
Entrant 41-50mo post ERS	0.002 (0.003)	-0.252*** (0.023)	-0.667*** (0.033)	0.002 (0.001)	-0.079*** (0.010)	-0.072*** (0.016)	-0.024** (0.011)	-18.207*** (6.673)	-0.022*** (0.003)
Entrant 50mo post ERS	0.009** (0.004)	-0.522*** (0.017)	-1.073*** (0.049)	0.006*** (0.001)	-0.098*** (0.009)	-0.090*** (0.012)	-0.046*** (0.006)	-10.312 (6.353)	-0.039*** (0.004)
N	344,561	344,561	344,561	344,561	68,450	68,450	68,450	344,339	344,561
Mean of dependent variable	0.15	7.46	7.32	0.02	0.87	0.79	0.84	294.33	0.05

Models control for city and date fixed effects. Robust standard errors clustered within city in parenthesis. * p<0.10, ** p<0.05, *** p<0.01

Models control for city and date fixed effects. Robust standard errors clustered within city in parenthesis. * p<0.10, ** p<0.05, *** p<0.01

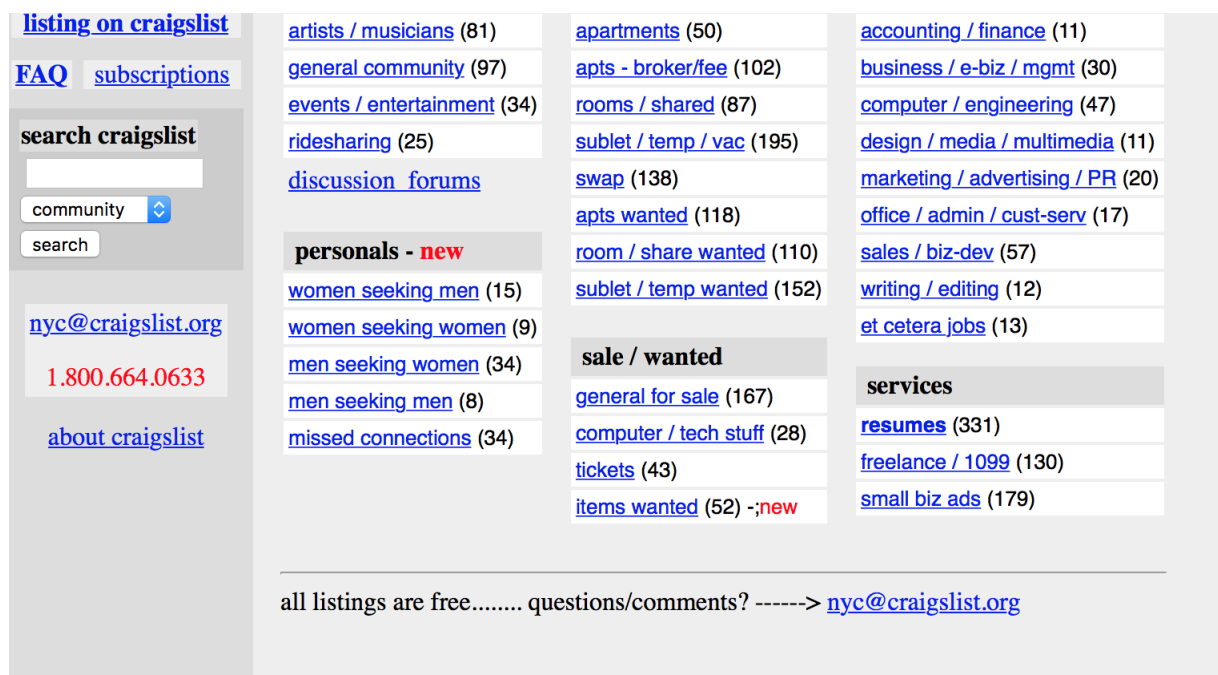
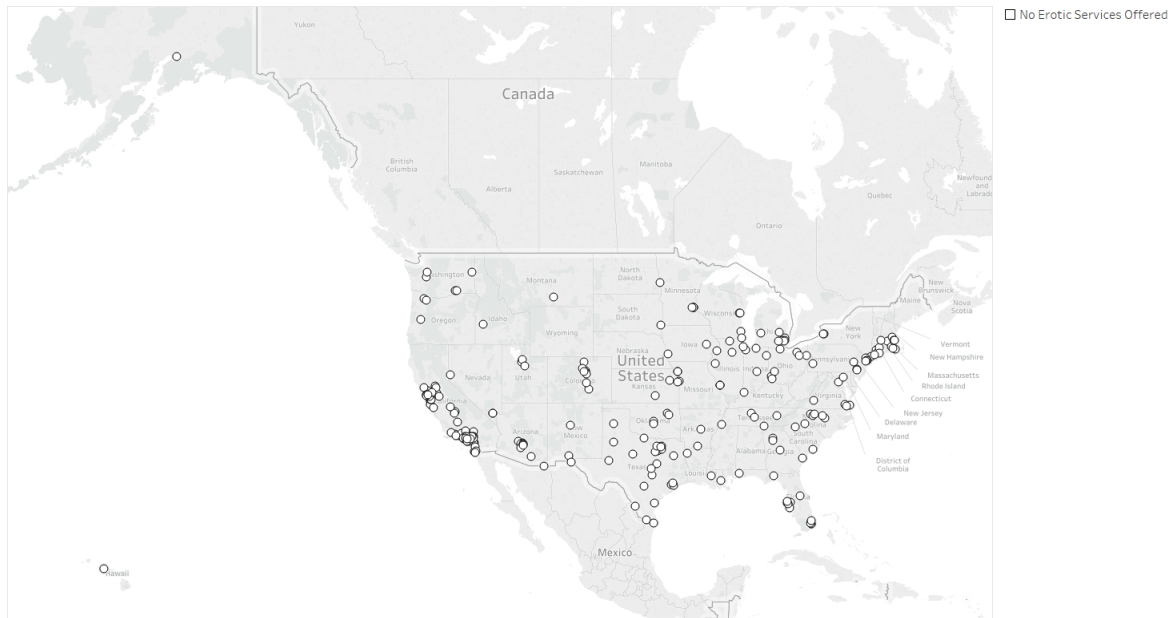


Figure 1 Picture of NYC Craigslist front page before erotic services was an section.



Figure 2 Picture of Craigslist front page with zoomed “services” section.

1995



April 2003

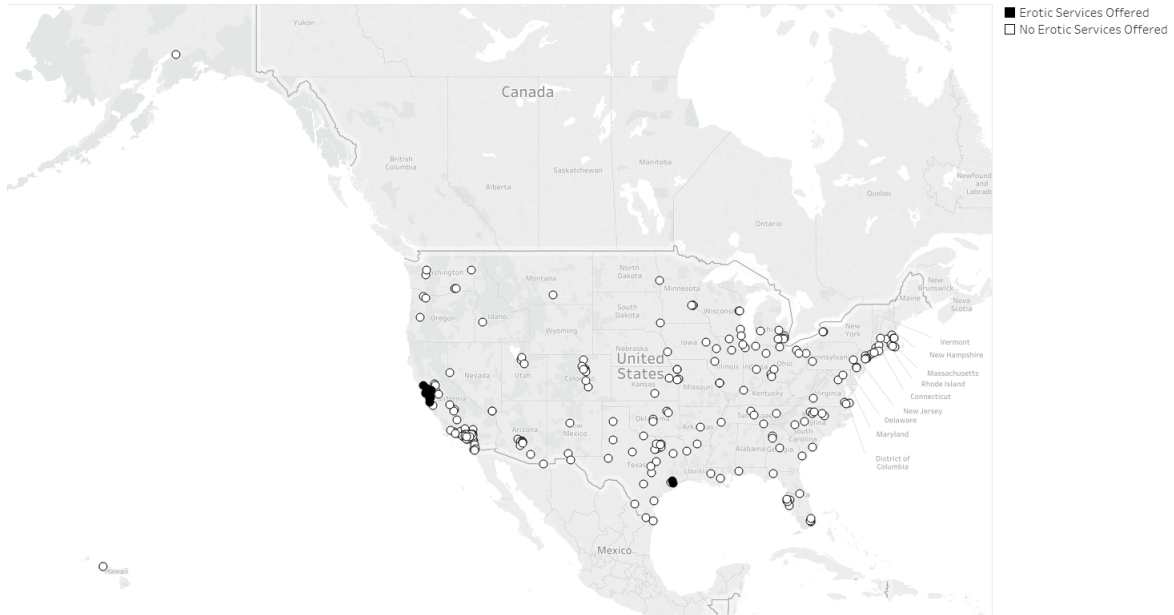
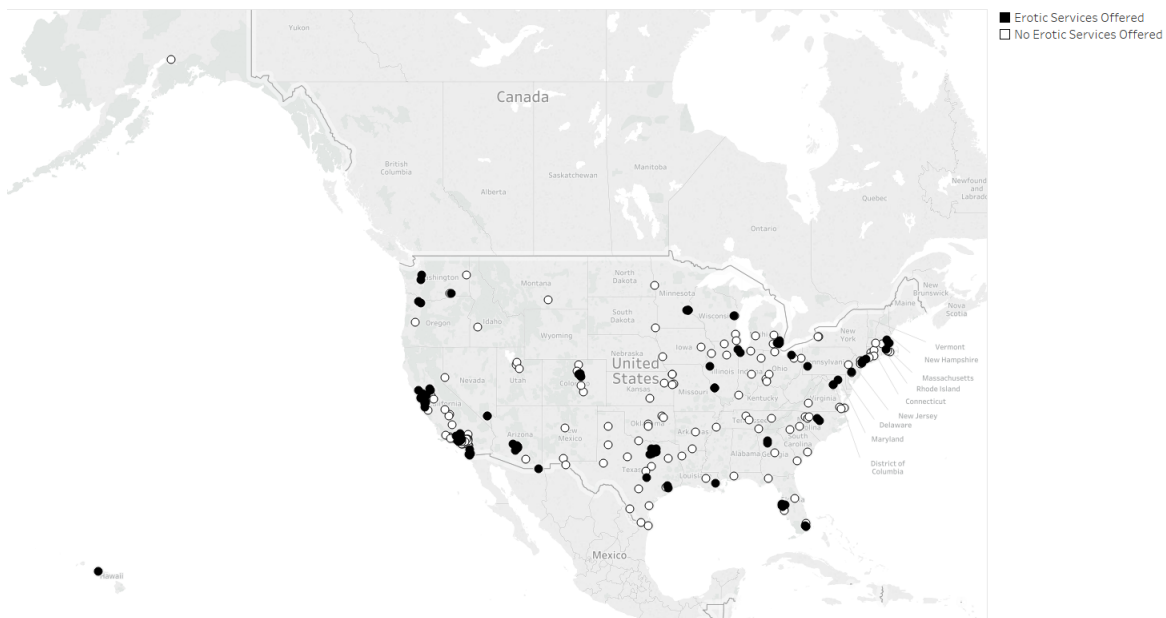


Figure 3 Top panel is 1995. Bottom panel is April 2003.

Jan 2004



Jan 2005

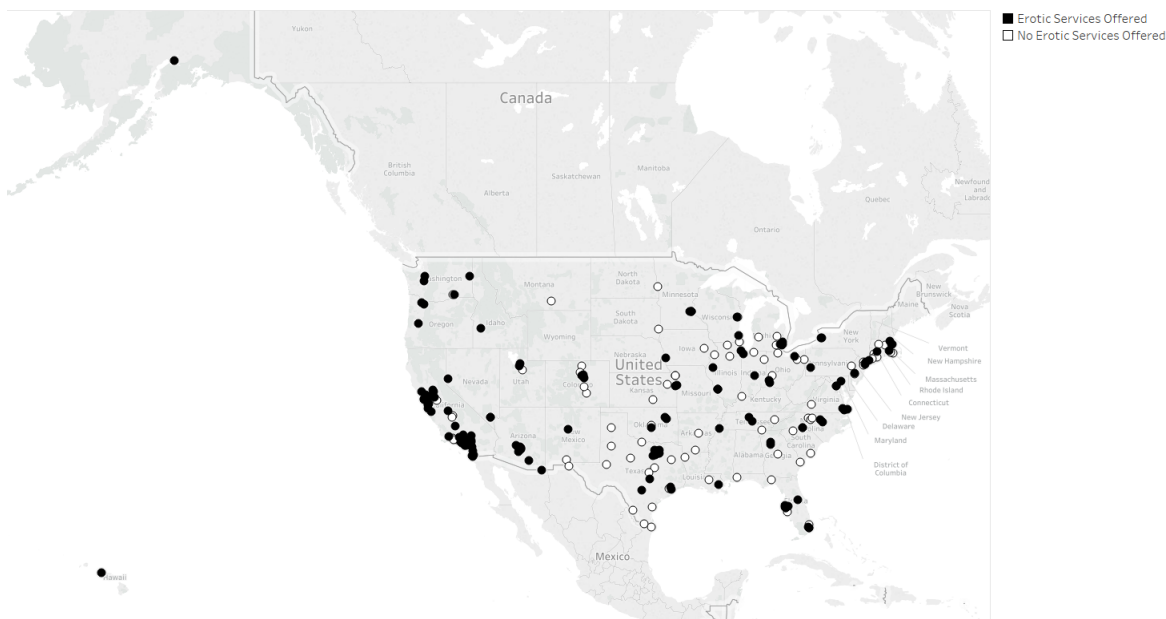
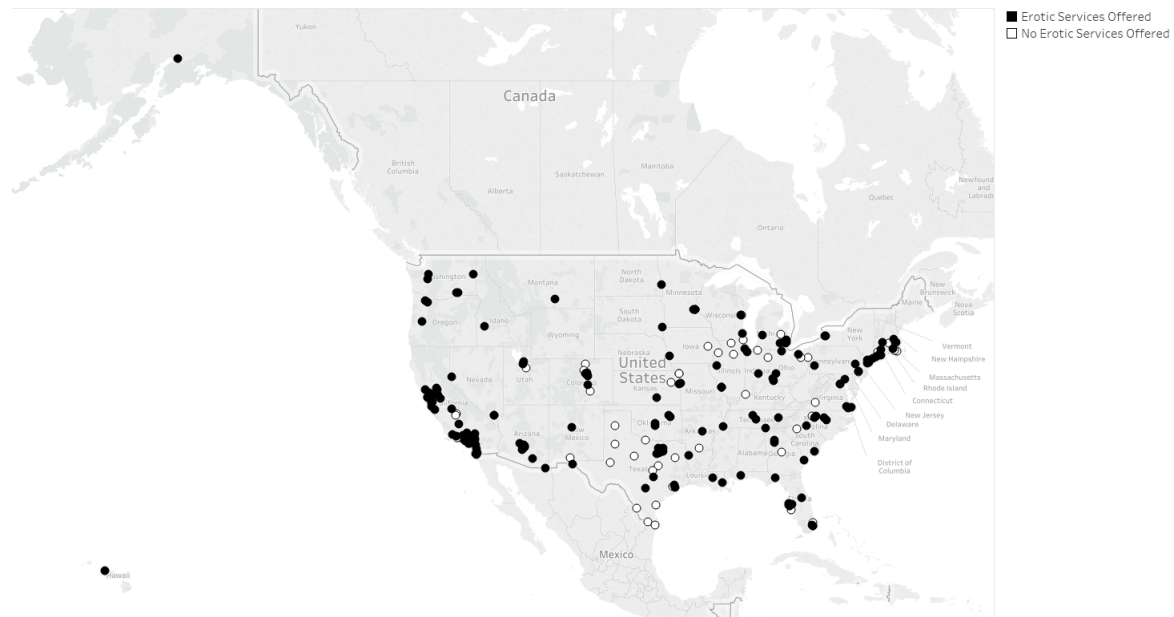


Figure 4 Top panel is Jan 2004. Bottom panel is Jan 2005.

Jan 2006



2009

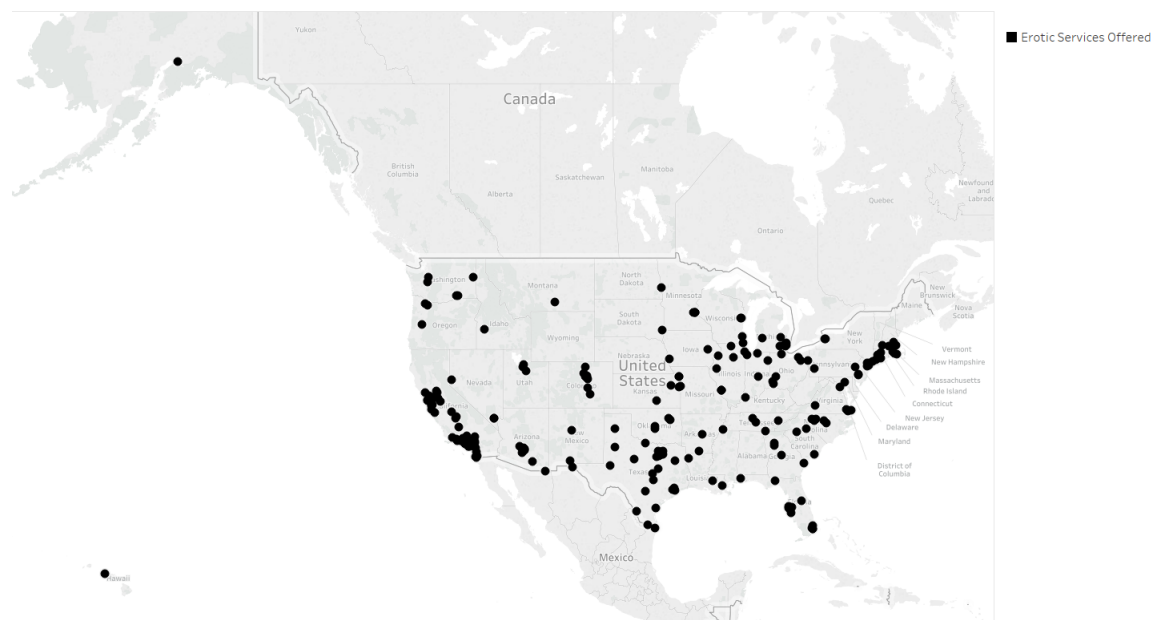


Figure 5 Top panel is Jan 2006. Bottom panel is 2009.

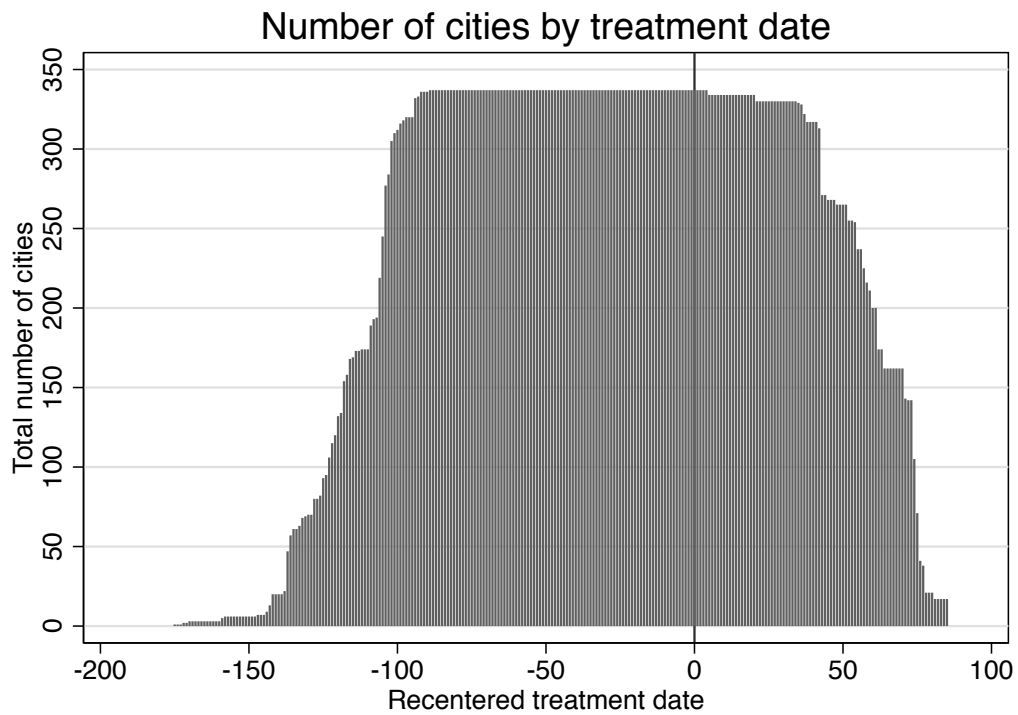


Figure 6 Number of cities represented in our sample relative to the time of treatment. The x-axis depicts the number of months until or after the introduction of ERS. The y-axis presents the number of cities that appear in our panel with the recentered treatment value of the x-axis.

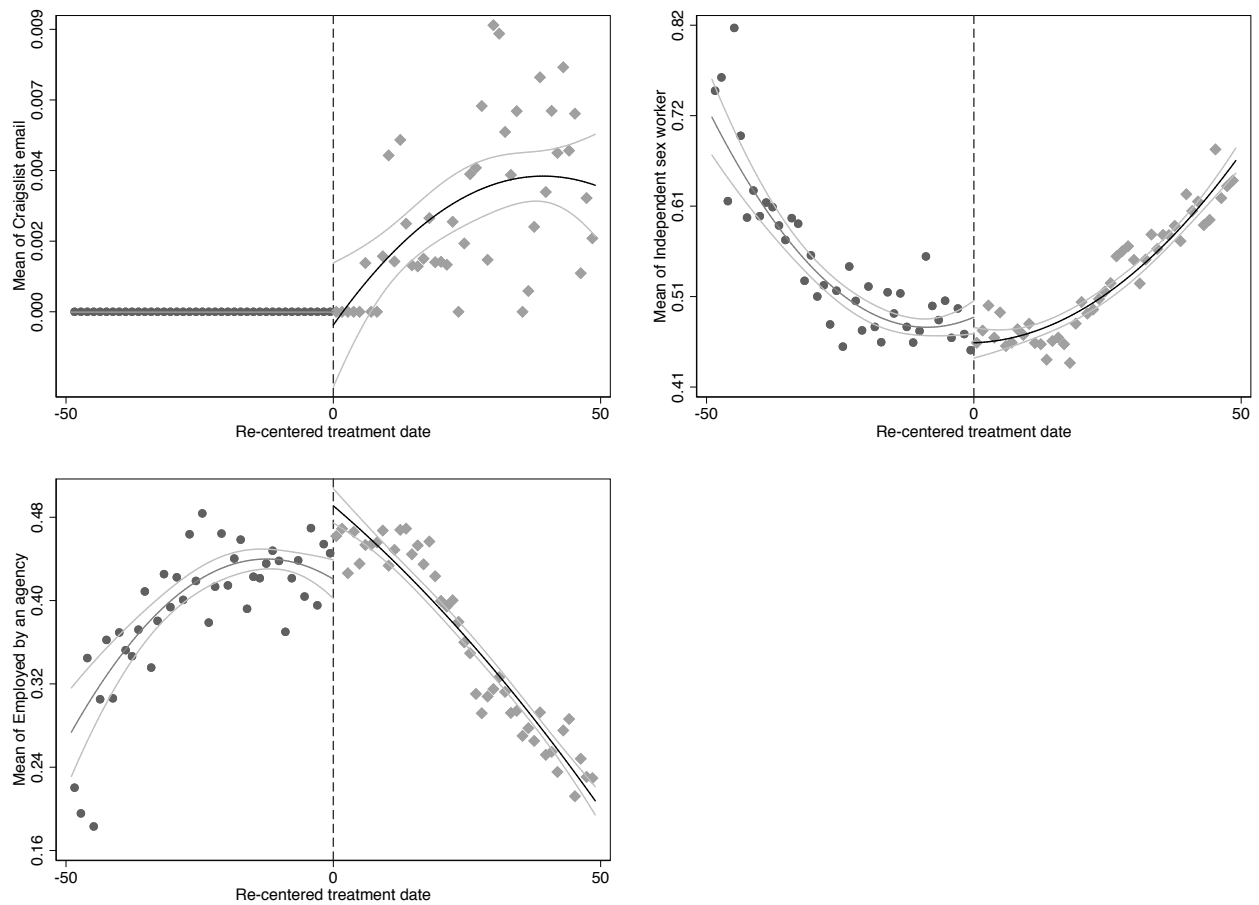
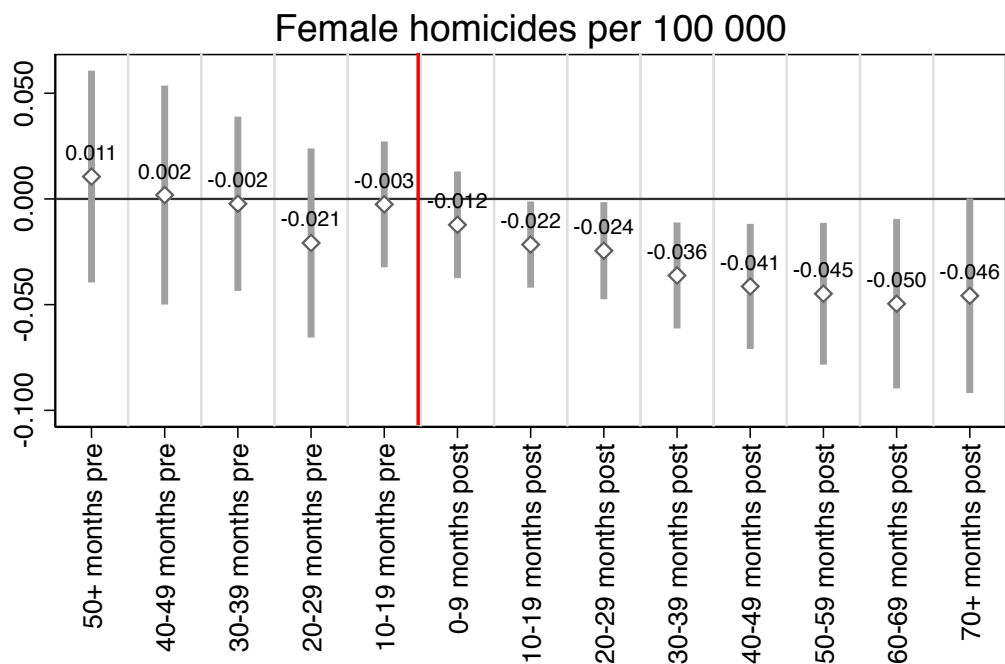
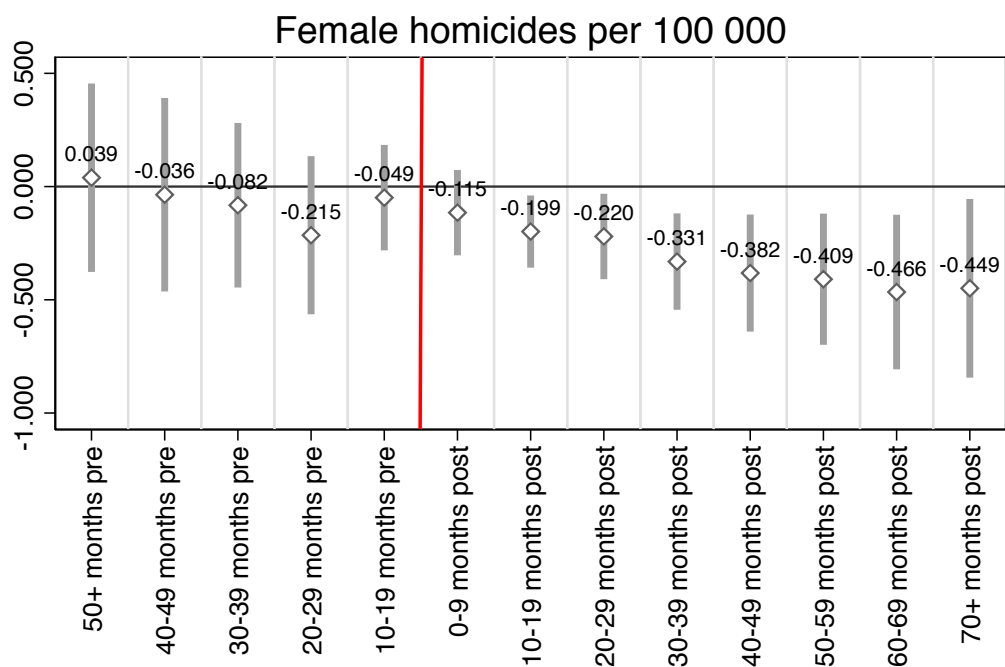


Figure 7 Conditional (binned) means of characteristics of providers before and after ERS. Top left is the likelihood a provider has a Craigslist email address. Top right is the probability of working as an independent sex worker. Bottom left is the probability of working for an agency.



Model estimated with OLS includes month-year city state-year fixed effects and population



Model estimated with Poisson includes month-year city state-year fixed effects and population

Figure 8 Regression coefficient box plots from equation 2 for female murders using a linear (top panel) and Poisson MLE panel model (bottom panel).

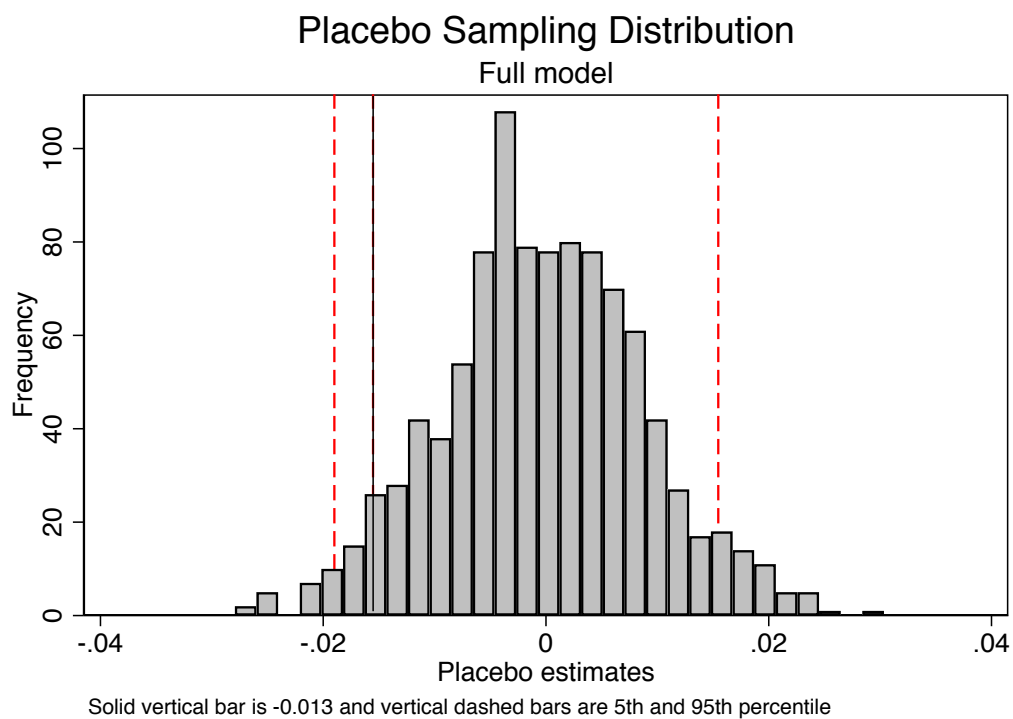


Figure 9 Sampling distribution of linear FE estimate of short and longterm ERS exposure on female homicide rates with 1,000 randomized treatment dates for inference. Black line is the true effect; red dashed lines are 5th and 95th percentiles.